FOREST INSECT PROBLEMS

in

SEQUOIA NATIONAL PARK

(Including the History of Previous Control Projects, Barkbeetle Infestations, Methods of Control, Itemization of Control Projects, and Bibliography of Reports Dealing with Insect Outbreaks.)

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Destructive forest insects have always been in our forests in small numbers, but at times, owing to the effects of a combination of factors not well understood, their numbers increase until millions of trees may be destroyed each season.

Since 1917 conditions seem to have been favorable, to a varying degree, for forest insect** outbreaks in Sequoia National Park. Because of a sudden increase in the number of dying Jeffrey, ponderosa, and sugar pine trees that year, J. M. Miller of the Bureau of Entomology and Ralph Hopping, then with the Forest Service, made what was the first survey in the Park to determine the actual losses. The results of this and subsequent surveys are discussed below.

PONDEROSA AND SUGAR PINE STANDS

A reconnaissance of the four major drainages on the west side of the park was made in this 1917 survey and heavy infestations requiring control work were found around Colony Mill and along the Middle Fork of the Kaweah River. The first treating to be done in the Park was begun in these two areas in the spring of 1918, when several hundred thousand board feet were treated. Control work, mainly of a maintenance character, was continued during 1919 and 1920 in the Marble Fork and Yucca Creek drainages. Following this three-year control campaign, the infestation subsided until 1928, when the western pine beetle began to kill off hundreds of trees on Milk Ranch Peak and along the East Fork of the Kaweah River.

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* Acknowledgment is made to Senior Entomologist J. M. Miller of the U. S. Bureau of Entomology and Plant Quarantine for material assistance in the preparation of this report.

** The following are the most important species: The western pine beetle in ponderosa pine; the mountain pine beetle in sugar, ponderosa, western white, and lodgepole pine; the Jeffrey pine beetle in Jeffrey pine; several species of Ips and two species of flatheads (Melanophila.)

A cruise of the Park made in 1930 by J. M. Miller of the Bureau of Entomology and Frank Been, then Park Naturalist, showed a loss that year of over 4,000 mature sugar and ponderosa pines. Control work was begun in the spring of 1931 in the Middle Fork and the Yucca Creek--Marble Fork drainages, where a total of 173 trees were treated. Because of adverse seasonal conditions and limited funds this program was inadequate and only a small part of this infested territory was covered. No treating was done during 1932, but in 1933, as the outbreak showed no signs of appreciable decrease, control work was carried out on an extensive scale, chiefly through the use of Civilian Conservation Corps labor. During this period 828 trees with a total volume of over a million board feet were treated.

Cruises made during the fall of 1933 over the entire ponderosa and sugar pine stands in the Park showed a loss of about 2,500 trees as compared with 4,000 in 1930. In 1934 about 1,000 trees were destroyed over the same area. Whether the decline will be permanent or not is difficult to say, but the results of the control work of the past indicate that if maintenance is continued each year the losses can be kept to a minimum in most of the areas.

Basing the estimate on figures secured since 1917, Sequoia National Park has lost over 24,000 mature sugar and ponderosa pines with a total volume of over 35½ million board feet during the past 18 years. There are on an average about 12 mature sugar or ponderosa pines to the acre; so that if all of the destroyed trees had been growing in a unit area there would now be about 2,000 acres of forest in Sequoia National Park containing nothing but dead trees and poles. A sample plot of about 100 acres was established in 1928 west of Atwell Mill and a cruise has been made each year since then of the plot to determine the annual losses. The figures for the losses between 1924 and 1928 are based on a cruise of trees that were judged to have died during this period. These cruises show that over the preceding decade (1924-1934) the total stand of timber over 12" D.B.H. on this plot has lost in volume 27 per cent of the ponderosa pine, and 11 per cent of the sugar pine, 13 per cent of the incense cedar, and 17 per cent of the white fir.

These figures show that actual losses over a relatively short period of time are considerable, and that the problem of dealing with destructive insects is a serious one.

THE PONDEROSA PINE PROBLEM

The Western pine beetle (Dendroctonus brevicomis) is responsible for the death of most of the ponderosa pine, though the mountain pine beetle (D. monticolae) also destroys a few of the smaller trees. The five-spined ponderosa pine engraver beetle (Ips confusus) top kills many trees, often making conditions favorable for successful attacks of either the western beetle or the flatheaded borers (Melanophila gentilis or M. californica.) The flatheads themselves are often primary, killing trees without aid from the bark beetles and attacking chiefly the middle and upper portions of the bole. The lower region of the tree then serves as a favorable breeding place for the western pine beetle, which is principally a lower bole

species; but when it is primary it leaves conditions suitable for the Ips and flathead attacks mentioned above, thus completing a vicious circle, as each species leaves breeding grounds for the other. With only one insect to control, the protection problem in the ponderosa pine stands would be relatively simple, but when there are the interlocking associations described above, actual spotting and treating are difficult.

THE SUGAR PINE PROBLEM

The mountain pine beetle (Dendroctonus monticolae) is the most important enemy of sugar pine trees but the five-spined ponderosa-pine engraver beetle (Ips confusus) and the pine flathead borer (Melanophila gentilis are also important factors. I. confusus attacks the tops of trees often preparing the way for a major attack by the mountain pine beetle. M. gentilis is more agressive and prefers the upper bole of large trees or makes a general attack on smaller trees. As there does not seem to be such a close relationship of these three beetles, control in the sugar pine stands is usually more simple.

JEFFREY PINE STANDS

The Jeffrey pine beetle is active in the Jeffrey pine along the General's Highway from Lodgepole Camp towards General Grant National Park, on the upper slopes of the Middle Fork and in River Valley. Though within the last few years it has become more active in these areas, it is still not a serious pest. During control jobs in the ponderosa pine stands infested Jeffrey pine trees have been treated along with the other trees so that the infestation has been kept rather low. In 1929, however, a small outbreak occured in the Lodgepole Camp area. Twenty-three trees were treated and since then a small amount of maintenance work has been necessary to keep it down.

LODGEPOLE PINE STANDS

In the 1917 survey the lodgepole pine stands of Sequoia National Park were found to be comparatively free from the ravages of forest insects, no infestations of note being recorded. So far as can be determined, the mountain pine beetle began to increase in the lodgepole areas about 1924, and by 1928 an aggressive outbreak had built up in the mature stands of the Hockett Meadow region. Small centers had also formed at Lodgepole Camp, Willow Meadow, and Clover Creek. Control work was done at Lodgepole Camp in the fall of 1928, which immediately checked this outbreak. In 1929 and 1930 the Willow Meadow center was also cleaned up and since then these areas have been quite clean of mountain pine infestation.

Once the mountain pine beetle becomes well established in a stand of lodgepole, it is difficult to control and treating has to be continued for several years before the effects of the work are noticeable. When the drop does occur, however, it is abrupt, and only a small amount of maintenance work is thereafter necessary. In the Hockett Meadow area the infestation continued to build up until in the spring of 1931 it was decided

to initiate control measures. Maintenance and an expansion of operations were necessary each year through the spring of 1934. Over this four-year period a total of 1522 trees, or an average of 380 trees a year were treated. Maintenance work was continued during the fall of 1934, but less than 100 infested trees could be located, so what was no doubt the beginning of a very serious epidemic was successfully headed off, but constant attention to the area must be given.

The results of the Clover Creek control project are similar. The first work was done in the fall of 1933 when 139 infested trees were treated; the following year 92 trees were treated, thus showing that the infestation had been materially reduced, but not as much as one would expect. It will probably require several more years of maintenance until the infestation is brought back to normal.

No cruises have been made in Kern River Canyon or Chagoopa Plateau but according to Ranger reports, the losses have been moderately heavy since 1928.

INCENSE CEDAR STANDS

There are considerable losses, especially of the smaller sized trees, from the attacks of the cedar bark beetle, Phloeosinus fulgens, and several other species of this group. In 1928-29 a very heavy killing by these insects occurred in the cedar pole stands above Paradise Creek. The larger trees are attacked by the round-headed amethyst borer, Semanotus amethystinus. They lay their eggs in apparently healthy trees and also dying ones and stumps.

No control work has ever been carried out against these insects and none will probably be needed, though at times they increase the fire hazard appreciably.

BIG TREE STANDS

The big tree is not immune to the attacks of insects, several species having been collected from green limbs or reared from recently fallen branches. Phloeosinus rubicundulus is a very common species in limbs that have fallen to the ground during the winter. Trachycele opulenta has also been collected from the trunk and bark but is a rather uncommon species. A heavy infestation of the Shasta scale, Aonidia shastae, was found in 1931 on the branches of small Big Trees growing along the Mineral King Road near Atwell Mill.

There are no records, however, of any insects causing the death of either young or mature big trees.

WHITE AND RED FIR STANDS

No control work has ever been conducted against the bark beetles infesting these two species of tree. Losses are wide-spread and often severe in stands of both reproduction and mature trees. The fir engraver

beetle (Scolytus ventralis) is the chief cause of these losses, though owing to its unusual habits no control measures are practicable aside from general sanitation work.

The fir engraver beetle is able to attack successfully a small portion of the bole of a tree and rear a brood without killing the tree. Consequently there is no way of telling when a tree is attacked unless the attacked area is close to the ground where it can be seen. The growing area destroyed by the brood of the beetle may then heal over so that after a period of years there will be no external evidence of the injury. At other times the beetles will attack and kill the top of a fir, which then sends up a lateral branch to take the place of the destroyed terminal, thus giving a bayonet-like appearance to the upper end of the trunk. Firs with tops like this are common through the forest. At other times the beetles will kill a group of small trees and at a distance the faded foliage appears to have been caused by a fire.

FOREST INSECT SURVEYS

In order to protect the forest properly it is important to know whether infestations are on the decline or increase, in just what area they are, and how much territory they cover. A series of surveys, necessary each year to secure this information is carried out by ranger districts, each district ranger then submitting a report of the results of his examinations. The proper way to conduct the surveys and the time of year for them have already been outlined and accompany the blanks when they are sent out each Fall to the district rangers for the tabulation of their findings.

These reports, however, deal with limited areas of the more noticeable outbreaks. Consequently it is important to have a knowledge of the losses or lack of losses for the park as a whole, which can be compared directly with losses of previous years. In order to secure this information, a system of topographic surveys for the sugar pine--ponderosa pine stands was inaugurated in the Fall of 1933. These surveys will be carried out each year, using the identical observation points for each region during each survey, with photographs also taken from the same points to show pictorially the actual conditions. The points of observation have been marked and are described in a report by the writer* so that whoever makes the survey will have little difficulty in locating these points.

BARK BEETLE CONTROL METHODS

During the past thirty years that bark beetle control projects have been carried on in the west methods employed have been gradually improved, refined, and standardized. The latest methods of control used today against the western pine beetle are excellently given in "The Control of the

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* Report on the 1933 Losses of Sugar Pine and Ponderosa Pine in Sequoia National Park...July 1934

Western Pine Beetle (Dendroctonus brevicomis)"**. The methods outlined in this bulletin can be used, for the most part, on any other bark beetle control project and should carefully be studied.

The following illustrations have been prepared to present graphically the principal methods that are used today on control projects.

For those who desire greater detail concerning insect control methods than is given in the accompanying drawings one should consult the mimeographed pamphlet "Insect Control Treating Instructions", prepared by Ranger-Forester Ernst of Yosemite National Park. Copies of these instructions are in Acting Forester's Office at Ash Mountain.

** A few copies are still available for distribution and may be secured by writing to the Branch of Forestry, N. P. S., 332 Hilgard Hall, Berkeley, California.

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Table 1, Summarizing the Insect Control Projects Carried Out
Since the First Project of 1918, Sequoia National Park

Location of Projects	Period Covered	No. of Acres Treated	Tree Species Treated	No. of Trees Treated	Board Feet Treated	Insect Controlled	Cost of Project
1) Yucca Creek--Marble Fork	5/21 to 6/10 1918	1500	Ponderosa P. Sugar Pine	12 45	44,520 182,810	Db* Dm**	$ 600.50
2) Yucca Creek--Marble Fork	May to Oct. 1919	1000	Ponderosa P. Sugar Pine	26 44	50,960 125,780	Db Dm	330.00
3) Yucca Creek--Marble Fork	April to Oct. 1920	1000	Ponderosa P. Sugar Pine	12 22	32,660 111,630	Db Dm	300.00
4) Yucca Creek--Marble Fork	3/4 to 4/23 1931	1000	Ponderosa P. Sugar Pine	61 14	140,000	Db Dm	1494.90
5) Yucca Creek--Marble Fork	Spring, 1933	1920	Ponderosa P. Sugar Pine	254	419,250	Db Dm	2688.87
6) Yucca Creek--Marble Fork	Summer, 1933	1600	Ponderosa P. Sugar Pine	98	166,600	Db Dm	(approx.) 1000.00 CCC Project
7) Yucca Creek--Marble Fork	March - April 1934	1920	Ponderosa P. Sugar Pine	98	174,890	Db Dm	1190.67 CCC Project
8) Yucca Creek--Marble Fork	Summer, 1934	1920	Ponderosa P. Sugar Pine	105	230,210	Db Dm	1576.67 CCC Project
9) Clover Creek	Fall, 1933	1380	Lodgepole P.	139	82,600	Dm	1072.23
10) Clover Creek	Fall, 1934	1380	Lodgepole P.	92	53,940	Dm	883.69 CCC Project

*Db - Western Pine Beetle **Dm - Mountain Pine Beetle ***Dj - Jeffrey Pine Beetle

Table 1, Summarizing the Insect Control Projects Carried Out Since the First Project of 1918, Sequoia National Park

(Continued)

Location of Projects	Period Covered	No. of Acres Treated	Tree Species Treated	No. of Trees Treated	Board Feet Treated	Insect Controlled	Cost of Project
11) Middle Fork of Kaweah Cliff Creek River Valley Granite Creek Buck Canyon Mehrten Creek	4/1 to 5/20 1918	4000	Ponderosa Pine Sugar Pine Jeffrey Pine	87 45 1	209,580 169,020 4,100	Db* Dm** Dj***	$ 1580.60
12) Middle Fork Mehrten Creek	3/17 to 4/18 1931	800	Ponderosa Pine Sugar Pine	97	150,000	Db Dm	2012.15
13) Middle Fork of Kaweah River Valley Granite Creek Buck Canyon	Oct. Nov.-'34	800	Ponderosa Pine Jeffrey Pine Sugar Pine	44	51,520	Db Dj	1025.21
Mehrten Creek Panther Creek	Nov.-Dec.-'34	2500	Ponderosa Pine Sugar Pine Jeffrey Pine	101	124,450	Dm	(CCC Projects) 3249.43
14) East Fork of Kaweah Atwell Mill	Oct., Nov., Dec., 1934	1200	Ponderosa Pine Sugar Pine	128	192,180	Db Dm	2745.36 (CCC Project)
15) Lodgepole Camp	Oct. 1928	500	Lodgepole Pine	43	36,660	Dm	280.00 (est.)
16) Lodgepole Camp	10/16-10/31 & 12/6-12/10-'29	500	Jeffrey Pine Lodgepole Pine	23 4	27,600 2,460	Dj Dm	215.00

*Db - Western Pine Beetle **Dm - Mountain Pine Beetle ***Jeffrey Pine Beetle

Table 1, Summarizing the Insect Control Projects Carried Out Since the First Project of 1918, Sequoia National Park

(Continued)

Location of Projects	Period Covered	No. of Acres Treated	Tree Species Treated	No. of Trees Treated	Board Feet Treated	Insect Controlled	Cost of Project
17) Willow Meadow Lodgepole Camp Giant Forest Camp	Oct.2-23,'30	1000	Lodgepole P. Jeffrey Pine Sugar Pine	41 56 4	35,420 67,200 8,000	Db* Dj*** Dm**	$ 475.20
18) Horse Creek Hockett Meadow	May 1-22,'31	1050	Lodgepole Pine Mountain Pine	286 4	178,870	Dm	1083.75
19) Horse Creek Hockett Meadow	Spring, 1932	1050	Lodgepole Pine	312	193,440	Dm	1559.65
20) Horse Creek Hockett Meadow	Fall, 1932	1050	Lodgepole Pine	165	78,050	Dm	433.24
21) Horse Creek Hockett Meadow	Oct.-Nov.'33	2000	Lodgepole Pine Mountain Pine	336 2	136,810 2,000	Dm	2373.34
22) Horse Creek Hockett Meadow	May-June 1934	1000	Mountain Pine	286	189,080	Dm	2391.23 (CCC Project)
23) Horse Creek Hockett Meadow	November 1934	1000	Lodgepole Pine	73	29,550	Dm	1074.83 (CCC Project)
TOTALS:		33,070		3,160	3,704,860		$31,636.52

*Db - Western Pine Beetle **Dm - Mountain Pine Beetle ***Dj - Jeffrey Pine Beetle